

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



SEP 13 1971

FOREST PEST LEAFLET 13

# **Fir Engraver** ACQUIREMENT SECTION CURRENT SERIAL RECORDS

Robert E. Stevens

The fir engraver, *Scolytus ventralis* Lec., is a native bark beetle which attacks most species of fir in the West and often causes heavy tree mortality. It is found from British Columbia south into Baja California and as far east as the Rocky Mountains (fig. 1). The fir engraver is the primary insect enemy of its three main host trees—white fir, grand fir, and red fir. It also attacks Douglas-fir, alpine fir, western hemlock, and Engelmann spruce.

In California alone, the fir engraver is responsible for the death of an estimated 450 million board feet of green timber each year. Under epidemic conditions, losses are even greater. Epidemic infestations are fairly local but are often very severe. In New Mexico, for example, some 37,000 trees were killed in 1954 on 6,000 acres of the Cibola National Forest.

Causes for these outbreaks are not well understood, but lowered resistance of the trees sometimes appears to be a contributing factor. The Cibola infestation coincided with a period of low rainfall. Several fir engraver outbreaks in California and southern Oregon have followed drought periods; others have taken place during periods of normal precipitation.

<sup>1</sup> Entomologist, Rocky Mountain Forest and Range Experiment Station, USDA Forest Service.

## **Evidence of Attack**

Like most other bark beetles, the fir engraver causes damage by mining in the cambium of the tree. Attacks are first indicated by tiny holes in the bark, about three thirty-seconds of an inch in diameter, through which the beetles have bored into the cambium. Most often these entrance holes are located in the roughened bark around the junction of a branch and the trunk. Reddish-brown boring dust lodged in bark crevices and in cobwebs along the trunk may also be seen.

Later, girdled twigs and branches begin to fade as their food and water supplies are disrupted by extension of beetle galleries. The appearance of this fading foliage, commonly called "flagging," is the first easily seen indication of a fir engraver infestation. Pitch tubes, often formed when bark beetles attack pines, are not produced on the firs. Streamers of clear pitch, however, often exude from the entrance holes and flow down the trunk for some distance. In some trees, pitch formed in response to the beetles mining may turn away or kill the attacking beetles.

Numerous attacks over the entire bole may girdle a tree in a single season; fading then becomes uniform throughout the crown (fig. 2). Lesser degrees of attack result in incomplete tree killing, either top killing or de-



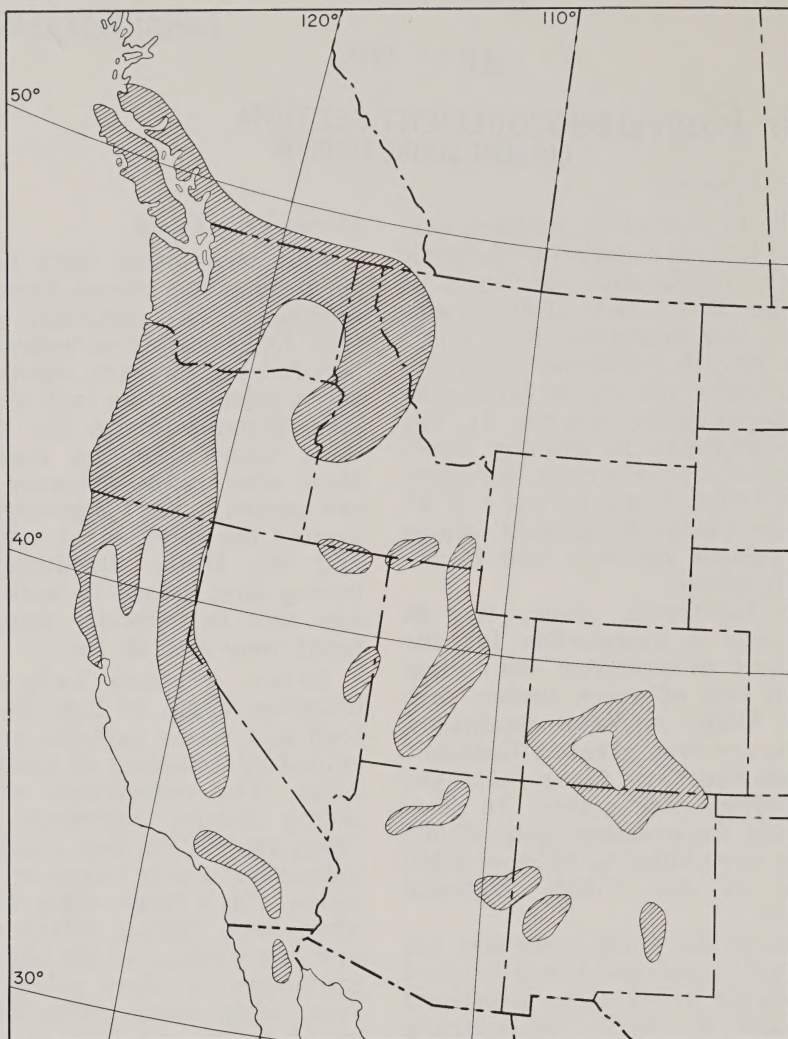


Figure 1.—Distribution of the fir engraver in western North America.

struction of scattered patches of cambium (fig. 3). Under these conditions, many trees recover. Patches of destroyed cambium heal over readily, and top-killed trees often send up new leaders.

#### The Insect

The adult fir engraver (fig. 4, *D*) is a small, shiny, black beetle about one-eighth of an inch in length, which from the side is seen to have the abdomen incurved. This characteristic is typical of all members of the genus

*Scolytus* and makes them easily recognizable. The eggs are minute, ovoid cylindrical, and pearly white in color. They hatch into tiny off-white larvae that pass through six molts, reaching adult size by the end of their development. Pupae are fragile and white; they, too, are adult size.

#### Life History and Habits

In the summer, newly matured adults emerge from infested trees and fly off in search of fresh host material. Time of emergence



F-480683

Figure 2.—Faded crowns in a white fir stand, a result of attacks by the fir engraver.

varies, probably depending primarily on temperature. Flight may occur any time from June through September, although most activity takes place during July and August.

Fir engravers readily attack standing green trees but will also attack and produce broods in freshly cut logs and recent windthrows. Attacks in individual living trees appear to be more or less by chance, rather than because of an attraction by a tree characteristic.

However, once a few attacks have begun in a tree an attractant is produced which may result in subsequent, rapid attacks by many beetles.

When the fir engraver is pres-

ent in normal numbers, death of mature trees is often hastened by the combined attacks of the engraver and the roundheaded fir borer, *Tetropium abietis* Fall. Under epidemic conditions, however, the fir engraver alone is generally responsible for the damage.

Attacks are made along the main trunk of the tree. The female beetle enters first, followed closely by the male. Mating takes place in a nuptial chamber or at the mouth of the entrance tunnel, and the male remains to help remove boring dust from the egg galleries.

From the nuptial chamber, the egg gallery is bored or tunneled out horizontally 2 to 3 inches in either direction (fig. 5). The fe-





Figure 3.—Patch killing in white fir. Bark removed to show areas of dead cambium. F-480678

male mines for awhile on one side of the chamber and then shifts to the other. Eggs are laid in tiny niches on both sides of the gallery. Each female lays between 100 and 300 eggs, and egg laying continues for 5 to 7 weeks.

Within 4 to 6 days after the egg gallery is started, a yellowish-brown discoloration of the surrounding area appears. This stain is caused by a fungus, *Trichosporium symbioticum* Wright, which is introduced by the beetles and spreads out in all directions from the gallery. It dries out the cambium region and is thought to be an important factor in aiding brood development.

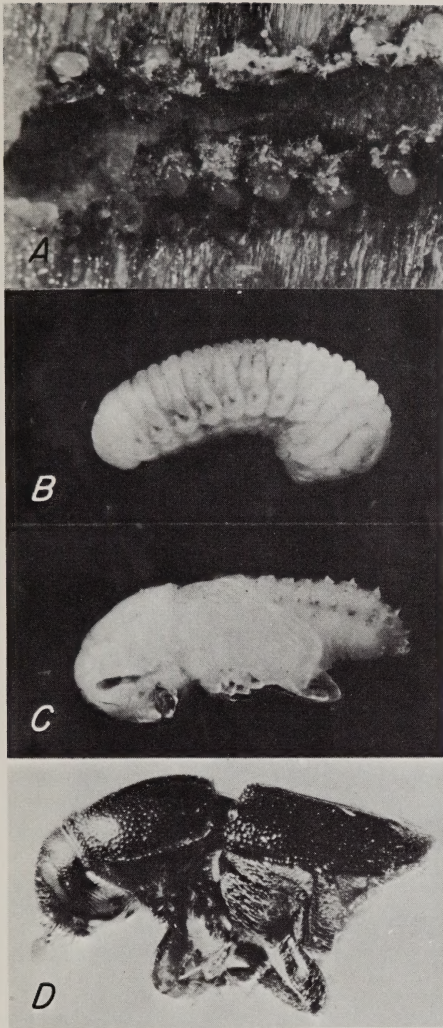
The eggs incubate for 9 to 14 days. After hatching, the tiny larvae begin tunneling their way

out into the cambium. Their larval mines are generally parallel and extend at right angles to the egg gallery (fig. 5). Completion of the larval stage requires from 41 days in the southern limits of the beetle's range to 380 days in the northern limits.

Fir engravers overwinter as both larvae and adults. Larvae feed for a short period in the spring and then construct pupal cells at the ends of their galleries. Pupation lasts from 7 to 14 days, and in another 2 weeks the new adults are ready to emerge.

Although there are variations at the extremes of its range, the fir engraver is generally considered to have one generation a year. There is, for example, one complete generation and a partial





F-480693, 480688, 480689, 480690

Figure 4.—Life stages of the fir engraver: A, Eggs (x7); B, larva (x10); C, pupa (x10); D, adult (x10).

second generation each year in the warmer locations. In cooler sites, such as north-facing slopes, 6,000 to 8,000 feet elevation in the Sierra Nevada on the other hand, 2 years are required for a complete life cycle.

#### Natural Control

Several insect parasites and predators are commonly associated with the fir engraver and

occasionally destroy a large part of the brood. The more important predators include two clerid beetles. The black-bellied clerid, *Enoclerus lecontei* Wolc., and the red-bellied clerid, *E. sphegeus* (Fabr.), both prey on engraver larvae and adults. Two braconid wasps, *Coeloides scolyti* Cush. and *C. brunneri* Vier., are parasitic on fir engraver larvae. Females of these wasps insert their ovipositors through the bark and lay their eggs directly on the developing larvae. A mite, *Pediculoides ventricosus* Newport, is also an important parasite on all stages of the fir engraver.

These and other natural enemies may help to control the engraver in some years, but they are not effective in preventing outbreaks.

#### Applied Control

Satisfactory control methods have not been devised for reducing fir engraver beetle populations over extensive areas. Broods in individual trees have been effectively controlled by any one of four standard treatments. When weather conditions permit, the infested tree can be felled and the bark burned in place or peeled and burned. In open situations, the infested tree can be felled, limbed, and left fully exposed to the sun. However, the logs must be rolled for the treatment to be effective on all sides. A third method involves submerging the tree or log in water for at least 6 weeks. Finally, broods may be killed with an ethylene dibromide spray. This is prepared by mixing 1 pint of 85-percent emulsifiable concentrate in No. 2 fuel oil to make 5 gallons. The spray is applied to the point of runoff with a low-pressure sprayer following felling, limbing, and bucking operations.

Reducing fir engraver populations over wide areas, however, is much more complicated and not





F-480681

Figure 5.—Egg and larval galleries 30 days after attack. Larvae of varying ages are represented by mines of different lengths. (Arrow indicates nuptial chamber.)

generally practical. The primary difficulty in controlling the insect under these conditions is the fir engraver's habit of infesting tops and scattered patches of cambium without killing the trees outright. Elimination of all infested material is the only hope for successful control. It is not practical, however, to search out and remove the many trees in an infested stand that might contain only a few active broods. Also, if left alone, such trees often recover completely. Consequently, direct control of the fir engraver is usually not advised.

Where possible, windthrown

trees and cut logs should be removed from the woods within a year, before the beetles have time to produce new broods. Thus far, forest management practices designed to remove susceptible trees before they are attacked have not been developed. No method has been found for recognizing susceptible trees before they become infested. Control of defoliating insects, thinning, removal of decadent trees, and other silvicultural practices aimed at maintaining healthy stand conditions appear to offer the best chance for minimizing engraver-caused losses.



## Reference

THE FIR ENGRAVER BEETLE, A SERIOUS  
ENEMY OF WHITE FIR AND RED FIR.  
GEORGE R. STRUBLE. U. S. Dep. Agr.  
Cir. 419, 11 p., illus. 1937.

## Caution

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed.

In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

**WARNING:** Recommendations for use of pesticides are reviewed regularly. The registrations on all suggested uses of pesticides in this publication were in effect at press time. Check with your County Agricultural Agent, State Agricultural Experiment Station, or local forester to determine if these recommendations are still current.



*Use Pesticides Safely*  
FOLLOW THE LABEL

U. S. DEPARTMENT OF AGRICULTURE

